



USING QUESTIONING STRATEGY TO ENHANCE SCIENTIFIC PROCESS SKILLS.

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Abstract

Since early age human being start to interact with environment, asks questions and seek answers. This question-answer process helps to understand science. To enable smooth learning of science, science process skills are important. But scientific process skills emphasize to use hands on activities to enhance scientific knowledge. This paper explains how questioning strategy can used to enhance science process skills among schools students which help to stimulate science education.

Keywords: Science process skills, Basic science process skills, Integrated science process skills and Questioning Strategy

“There is a single light of science, and to brighten it anywhere is to brighten it everywhere.”

Isaac Asimov

Science has the capability to improve of our lives. It is believed that the science of this 21st century will be more and more unified - global issues asking for answers from across the spectrum of knowledge and research, ideas and technologies integrated to provide global solutions. So that learning of science becomes very important 21 st century. Science is a knowledge about or study of the natural world based on facts learned through experiments and observation. Science can be learned lively and interestingly by providing wealthy learning experiences. Learning of science is effective if the learner engaged in a meaningful learning environment. So that teaching of science shift from the teacher-centered method to child-centered activity based method which encourages students preparing for their careers in science led to the development of process skills. But in present situation science is being taught is school in a very mechanical way, students are confined to their textbooks, examination oriented, rote memorization is dominantly prevailing, there is less scope for creative, problem solving, critical thinking etc (National Knowledge Commission, 2009).Process and product is one of the aspects of Nature of science but present coaching in schools largely emphasizing products of science such as facts, concepts, principles, laws and theory process of science ignored by teachers during the teaching learning process of science. Students are hardly encouraged to observe, explore, measure, classify and analyze the everyday experience occurring around them.(Ramesh,Patel 2013).National Curriculum Framework (2005) cites that Processvalidity requires that the curriculum engage the learner in acquiring the methods and processes that lead to generation and validation of scientific knowledge, and nurture the natural curiosityand creativity of the child in science. Process



validity is an important criterion since it helps the student in 'learning to learn' science. This process approach will make the children to think critically on a particular problem, also develop scientific attitude. Process aspects of science cannot develop by chalk and talk method; it should be developed through by using various teaching strategies.

Scientific Process Skills

The research indicates that the process-approach programs of the sixties and seventies, Elementary Science Study (ESS), Science Curriculum Improvement Study (SCIS), and Science-A Process Approach (SAPA), these projects is a pioneer for most of the country and it emphasized the scientific process skills through different approaches of teaching science such as inquiry approach, discovery approach, investigatory approach through which students can engage in scientific method and acquire knowledge and skills. India also not exceptional to bring curriculum reform in general and specifically science, effort has been taken later 1960s to strengthen the science education in the schools through various committees and reports. Many projects like Agastiya, Vaganmandir, Hoshangabad Science Teaching Programme also carried out to improve science teaching at state and national levels. NCERT is the national level body undertaken many project which includes providing science kits, improving laboratory facility, training science teachers, providing science equipment's to schools, developed manual for science teachers. On the other side various commissions including recent document NCF (2005) also recommended that science teaching was made compulsory in school education and development of science process skills is one of the objectives of science teaching..(Ramesh & Patel 2013).

Conception of Scientific Process Skills

Students in process-approach programs learn more than do students in traditional textbook-based programs. (Bredderman, 1983). Science process skills are special skills that simplify learning science, activate students, develop students' sense of responsibility in their own learning, increase the permanency of learning, as well as teach them the research methods (Korkmaz, 1997; Karamustafao lu, 2003 cited in karamustafaoglu, 2011). According to Padilla's (1990) science process skills are "transferable abilities, appropriate to many science disciplines, and reflective of the behavior of scientists." He classified the process skills into two they are basic and integrated skills. Basic science processing involves: observing, question raising, measuring, communicating, classifying, predicting and inferring, Integrated science process skills require controlling variables, defining terms operationally, formulating hypotheses, interpreting data, and formulating models. The basic and integrated skills improve the thinking and reasoning abilities.

The basic and integrated science process skills sponsored by the Padilla's are schematically represented in the following Figure

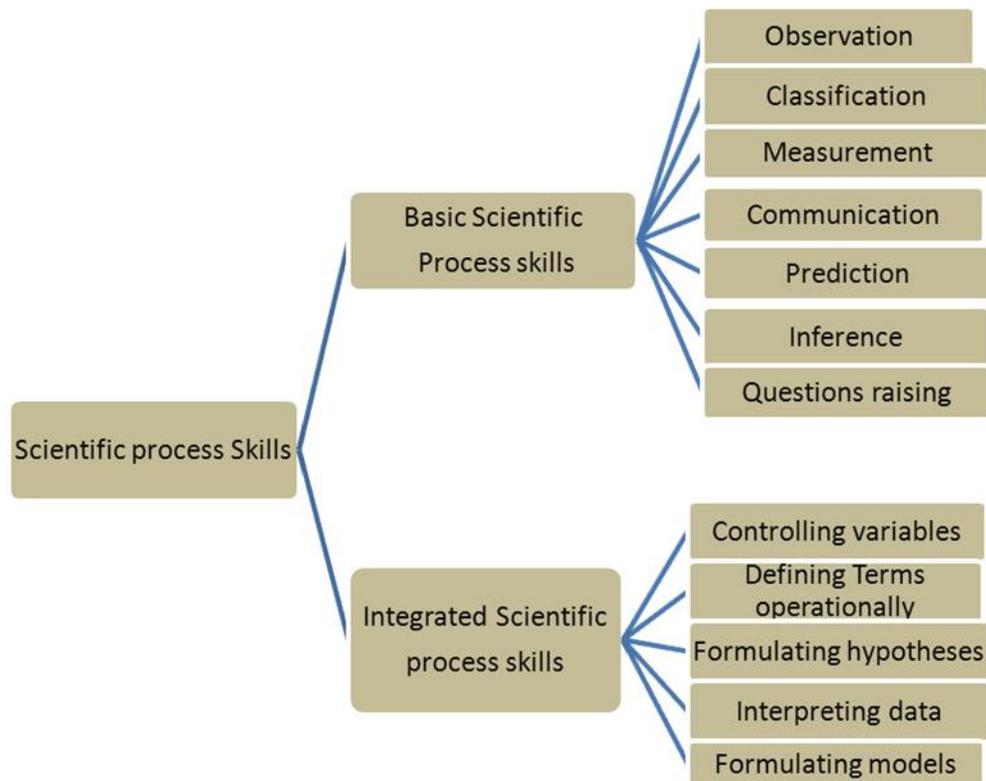


Fig. 1– Scientific Process Skills

Questioning Strategy and Scientific process Skills

Freire (1993) believes that students would be more eager to learn if they could observe teachers caring enough about them to use pedagogical technique based on knowledge of their cultures. One of the important goals of school education and pedagogical objectives is development of scientific process skills among children irrespective to the caste, culture, economic status, gender etc. To achieve the goal, teachers have to provide opportunities to children to learn a variety of ways of learning experiences such as doing things, experimentation, reading, discussion, asking, listening, thinking, reflecting and expressing oneself in speech or writing both individually and with others by using different teaching strategies. Questioning strategy is one most important which enhances children's scientific process skills.

What is questioning

Socrates (469 B.C. - 399 B.C.) was a Greek philosopher, one of the founders of Western philosophy. He founded a method named after him, Socratic method, a form of inquiry and discussion between individuals, based on asking and answering questions to stimulate critical thinking and to illuminate ideas. In the field of education, this method plays a vital role for creating curiosity about facts and gaining knowledge to satisfy the queries.



Thinking is fundamental to all learning and there is no learning without thinking, but central to thinking is questioning. It is our questions that fuel and drive our thinking.

A question which is defined as "An expression of inquiry that invites or calls for a reply"(Free Dictionary).Any invention starts with curiosity and curiosity asks many questions. How it happens? , Why this happened? What is the impact and so on. A questioning is effective tool for generating curiosity among students about the facts happening around as well as making them aware of what they don't know.

In science education there are two types of questions 1) Information Based 2) Action Based.

- 1) Information Based questions – These are the questions which can be solved by discussions, asking to other experts. It promotes science as information and always yields a correct end product as answer.
e.g. – Does all birds builds a nest?
- 2) Action Based questions – These are the questions which can be solved by carrying out experiments , earning experience .This promotes the science as way of workingand stimulates student to find out the answers of their questions by their own way and due to this the answers may vary.
e.g. – Why rainbow has seven colours?

How it works

If schools want to train pupils with the skills of learning, then it becomes obvious that a primary skill for any independent learner is the ability to ask clear, well defined and relevant questions, but in school, teacher is the center of attention and a source of knowledge for student and he asks the questions and expects proper answers from students,this process is always seems to be unidirectional. In schools while handling students, the role of teacher should be as facilitator than an instructor. He should encourage students to ask questions. But it is also a skill of a teacher to answer them properly and correctly. This is depending on the preparation done by a teacher.

It is not necessary that every question need to be answered, but it is essential to study the questions and handle them. Science is itself borne by questions, and hence to find out the answers the inventions carried out.

When teacher asks questions in the classroom, the teacher starts exhibiting the process that students can and should use; encourage them to use following questioning strategies to assess what they have learned, to develop their thinking skills.

Strategies for Questioning

- **Planning the questions according to the goal of curriculum.**
- **Elude asking leading questions.**Leading questions are having answer inside the questions themselves, hence they will not promote thinking
- **Use a yes-or-no type questions with an additional questions.**

- **Use of direct, clear and specific questions.** In class discussions, instead of beginning with a single question that is multilayered and complex, use a sequence of questions to build depth and complexity.
- **In class discussions, always use only one question at a time.** When teacher ask more than one question, students often do not respond because they are confused which question teacher want them to answer.
- **Emphasize to have healthy and interactive session in class.** Encourage students to ask questions even though they feel it's worth to ask.
- **Use different types of questions.** Use mostly of closed ended questions which have definite answers. Open ended questions lead to many answers and can divert the attentions of class to only type of discussion. Even teacher can also managerial type of questions.

Responding Effectively

- Allow students to spend some time for thinking and formulate responses.
- Do not interrupt student's answers.
- Always show positive response even though the answer is wrong.
- Develop responses that keep students thinking.
- Point out the incorrect or weak part of answer and ask simple questions which will lead to correct and strong answer.

Improve Questioning

After having the session in class, teacher has to think about the response in class, asses the questions asked and response from student. Teacher should analyze the student's way of thinking and refine the questions or add some other type of questions so that to promote their curiosity. The questioning strategy is summarized as below.

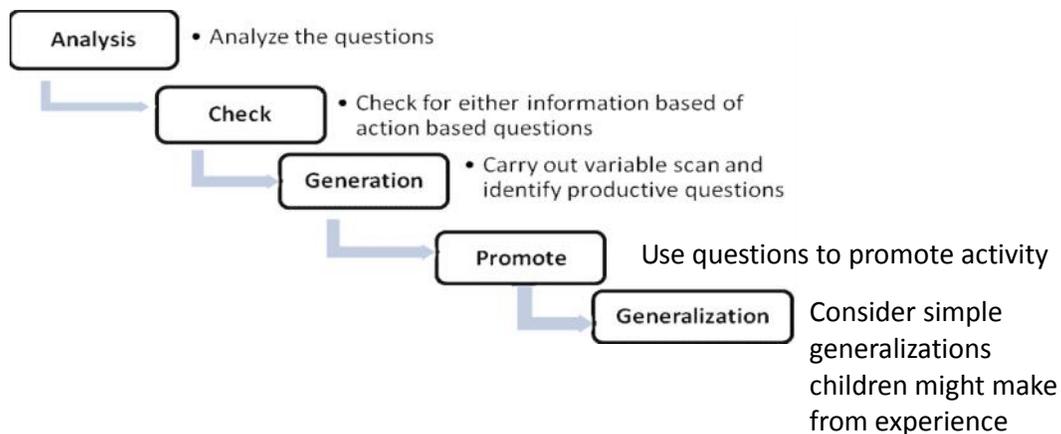
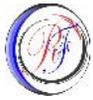


Fig. 2– Questioning Strategy



Questioning strategy to improve Science process skills

Questioning strategy can be used to promote specific scientific process skills. This is beneficial for students for enhancing their scientific process skills when they are exposed to number of questions related to facts happening around. But this approach is driven by examples that means teacher should ask student why leaf become red or brown in winter season?. The questions can be used to carry out task where the basic scientific process are used or used to promote. Here let us consider a task of differentiating between plants.

Observation

- 1) What are the different types of plants you can see around?
- 2) What are the differences between their roots, leaves and flowers?
- 3) What are the similarities between the plants?

Classification

- 1) How the plants can be classified on the basis of seeds?
- 2) How the plants can be classified on the basis of flowers?
- 3) How the plants can be classified on the basis of roots?

Measurement

- 1) How many plants are having flowers?
- 2) How many plants are having same type of flowers or roots?
- 3) What is the average age of plants(like shrubs, trees)?

Communication

- 1) How to put records of all observations?
- 2) How to analyze the data?
- 3) How to represent the data to a group of students?

Prediction

- 1) What will happen if all leaves of plant cut down?
- 2) If one cut the flowers regularly, can the plant is able to generate the seeds?
- 3) If one pours ample amount of water to plant, dose their growth rate will increase?

Questions raising

- 1) What would you like to know about these plants?
- 2) What would you like to find out about these plants?
- 3) What would you like to know about these roots of plants?

Inference

- 1) What can be done to grow the plants healthily?
- 2) What measures can be taken to maintain the fertility of soil?



3) How water can be conserved to use it in summer season?

Challenges in Using Questioning Strategy

1) Reluctance of students to answer the questions. – Students feel shy or non-responsive to respond to questions, this happens due to lack of knowledge about content

2) Unpreparedness or ill preparedness of teachers.- Many teachers are not able to answer the questions properly or correctly. This affects on generating further questions.

3) No coordination between way of answering of teachers and understanding of student.- Sometimes student don't understand the answer or even the questions, even teachers doesn't bother about this fact and lecture become unidirectional.

4) Poor pre-service training about handling questions in class.- In pre-service training of teachers , it not taught them how to handle the questions raised by the students, how tenderness the teacher should show while carrying out the questioning session.

Conclusion

To enhance scientific process skills, it is always believed that only hands on activities can be helpful, but along with hands on activities questioning strategy is also rather equally useful. Effective use of questioning strategy can promote thinking among students and forces them to have experiments to get the answers. Carrying group discussions and argumentation act as stimuli for a group of students to think and respond critically on problems.

Reference

1. American Association for the Advancement of Science. (1993). *Benchmark of scientific literacy*. New York, NY: Oxford University Press.
2. Bhatt, D. (1983), *Science process skills in Teaching and Learning*, New Delhi: Commonwealth Publishers.
3. Freire, P. (1993). *Pedagogy of the oppressed: New revised 20th-anniversary edition*. New York.
4. Harlen.W,Elstgeest.J,(2006),UNESCO *Sourcebook for science in the primary school A workshop approach to teacher education*, National Book Trust ,INDIA
5. Karamustafoglu (2011). Improving the science process skills ability of science student teachers using diagram, *Eurasian Journal of physical and Chemistry Education*
6. Lederman, N. G. (1992). Students and teachers conceptions of the nature of science: A review of the research. *Journal of Research in Science Teaching*,
7. National Knowledge Commission (2006-09) Report of the Nation, Published by National Knowledge Commission, Government.



8. National Policy on Education (1986), Ministry of Human Resource, Department of Education, Government of India
9. NCERT (2005). *National Curriculum Framework*, New Delhi: National Council of Educational Research and Training, Government of India, New Delhi.
10. Padilla, M.J. (1990). The science process skills (Research matters – to the science teacher No. 9004). Retrieved from *National Association of Research in Science Teaching*, website: <http://www.narst.org/publications/research/skill.cfm>
12. Ramesh, M. & Patel, R.C.(2013).Critical Pedagogy for Constructing Knowledge and Process
13. Skills in Science *Educationia Confab India*
14. Sheeba.M. N,(2013)An Anatomy of Science Process Skills In The Light Of The Challenges to Realize Science Instruction Leading To Global Excellence in Education, *Educational Confab India*